

IV. Remarks**A. Amendments to the Specification**

The paragraph beginning at the top of Page 6 was amended to correct spelling and other errors. In addition, the last paragraph beginning on page 10 was amended for the same reasons.

B. Amendments to Claims**1. Claim Objections**

Claims 18, 19 and 22 have been amended as suggested by the Examiner.

Reconsideration and withdrawal of these claims objections are respectfully requested.

2. Rejection under 35 USC § 112

Claim 19 has been amended to recite “base elements of the bipolar transistor array” rather than “the bases”. The Applicant submits that this amendment addresses the indefiniteness rejection of Claim 19.

Claim 20 has been amended to depend from Claim 19 and to recite “collector elements” rather than “said first collector regions”. Applicant submits that this amendment addresses the indefiniteness rejections of Claim 20.

Claim 21 has been amended to depend from Claim 19, to recite “said plurality of laterally spaced third regions by which said multiple emitter elements are formed” and “said third semiconductor layer.” It is submitted that each of these recitations has antecedent basis.

Claim 22 has been amended to depend from Claim 20, to recite “one of said base horizontal conductor contact stripes”, “said top collector horizontal contact conductor stripes”, “said multiple emitter elements”, “a second of said base horizontal conductor contacts stripes”, “the bottom collector horizontal contact conductor stripes” and “base regions”. It is submitted that each of these recitations has antecedent basis.

Claim 23 has been amended to depend from Claim 19, and now recites “said multiple emitter elements”, and “respective ones of said N horizontal stripe elements.” It is submitted that each of these recitations has antecedent basis.

Claim 24 has been amended to depend from Claim 22 and to recite “said base horizontal conductor contact stripes” and “said multiple emitter elements.” It is submitted that each of these recitations has antecedent bases. The phrase “typically ground” has also been removed from Claim 24 and recited in new Claim 47, examination of which is requested.

C. Claim Rejection under 35 USC § 102(b)

The Action rejects Independent Claim 18 as being anticipated by U.S. Patent No. 5,850,095 to Chen et al. Claim 18 includes features similar to those claimed in issued Claim 12 of the parent patent, U.S. Patent No. 5,850,095. To that end, the Applicant repeats herein the arguments which the Examiner found persuasive in allowing Claim 12 of the parent patent. Reconsideration and withdrawal of the rejection of Claim 18 in view of the following arguments are respectfully requested.

Referring to Chen et al., Fig. 5, the protection circuit relies on an SCR device 80 in conjunction with an additional base resistor R 36 in series with the inherent bipolar base resistors for device activation. Indeed, this is shown in detail in Chen et al. Fig. 3. As described in the referenced patent, column 2, line 38, "As...the invention provides a ... ESD circuit that is achieved through uniform turn-on of multi emitter fingers from an internal Zener diode current source." Continuing the description in column 3 line 1, "The Zener trigger circuit 30 includes a zener diode 32 that is coupled serially between pad 34 and resistor 36."

Applicant's claimed invention does not require the additional devices to assure uniform turn on of multiple emitter fingers. This fact reduces the design and processing requirements of the claimed invention device over the Chen et al. structure. The claimed invention has a simpler, unique concept with less overall components, such as a Zener diode and associated resistor required by Chen et al.

The claimed invention achieves uniform turn on by the use of a unique emitter shape as depicted in Applicant's specification Figs. 5-5D, and described in detail in Applicant's specification in the paragraph beginning on line 3 of page 8. Specifically referring to the sixth sentence beginning on line 12 of page 8. "The continuous serpentine emitter conductor 28A provides the capability of a single emitter current which provides a high assurance that all the base elements will conduct minimizing the possibility of localized device damage caused by excessive current, and therefore excessive joule heating, in any one transistor element. This provides good ESD protection while at the same time minimizing the device area."

It should be noted that Chen et al. states in column 1 line 51, “Moreover, when NPN transistors are used for ESD protection in sub-micron BiCMOS and CMOS applications, the ESD threshold level typically scales with the length of the emitter finger, and not with the number of provided fingers.”

This is typically caused by minute variations in process parameters that impedes the ability for all the fingers to carry an equal share of the ESD current. Referring to Applicant’s specification, the prior art is shown in Fig. 3 and Fig. 4. The Fig. 3 equivalent circuit shows four bipolar transistors in parallel between first and second voltage sources. It also shows the associated emitter-base resistors Rb1 through Rb4. It is desirable to have these resistances as identical as possible, but process variations make this difficult.

This is highlighted in Applicant’s specification by the sentence beginning on line 21 of page 2, “However, there are still four different emitter fingers 28 in Fig. 4 in which process variation can cause slight differences in electrical characteristics as well as in the characteristics of the base elements. This design structure therefore cannot always assure turn-on of all the emitter base elements to maximize the device ESD current capability.” This is the reason ESD protection does not scale with the number of fingers.

Applicant’s claimed invention overcomes this drawback without the use of extra components such as zener diodes, by using uniquely shaped emitters continuously connected to allow the ESD protection to scale with the length of the emitter.

As an example, the “serpentine” shaped emitter claimed in dependent Claim 23 is shown in Applicant’s Fig. 5A. This novel approach to improving ESD protection without using additional components is not anticipated by Chen et al. Although Claim 18 does not specifically describe the specific unique emitter shape of Applicant’s claimed invention, it is required for device operation to have the elements described in those claims. The device structure must be taken in total to produce a functioning protection device with improved ESD capability. The collector and base elements together with associated contact regions are an integral part of a functioning device with unique emitter characteristics of the claimed invention.

In summary, Applicant’s claimed invention has the uniqueness of the emitter construction that enables an electrical connection “on-chip”. The base configuration and emitter configuration provide assurance that all elements of the device carry current during an ESD event. This provides the ESD protection efficiency of an extended length emitter without additional devices such as a zener while maintaining a relatively compact device area.

It is not believed obvious that Applicant’s claimed invention could be anticipated by Chen et al. Indeed, Chen et al. teaches away from Applicant’s invention by requiring additional components such as a zener diode and resistor. Further, Chen et al. does not describe in any way the shape of the emitter used.

It is therefore respectfully requested that the rejection of Claims 1-3 and 12-14 under U.S.C. §102(b) be reconsidered.

D. Allowable Subject Matter

Claims 19-24 stand rejected only under §112, ¶2. The Applicant is grateful to the Examiner for recognizing the allowable subject matter in Claims 19-24.

E. New Claims

New Claims 47-70 have been added, examination of which is respectfully requested.

New independent Claims 51 and 61 are similar to allowable Claim 18, but differ in scope by adding certain features of Claim 19 therein. In addition, Claim 51 recites that the ESD protection structure “consist essentially of” the recited elements. This recitation of consisting essentially of is not intended to exclude additional features or elements such as connection means, but rather to stress that the ESD structure does not require additional functional elements such as Zener diodes as required by references such as Chen in order to achieve the improve electrostatic discharge damage protection.

New Claims 48, 59 and 69 have been added and are directed to the box type multiple emitter configuration shown in FIG. 5D. Claim 18 is certainly generic with respect to this embodiment.

New Claims 49, 60 and 70 have been added and are directed to the comb type multiple emitter configuration shown in FIG. 5C. Claim 18 is certainly generic with respect to this embodiment.

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New Claims 50, 58 and 68 have been added and are directed to the interdigitated embodiment base configuration shown in FIG. 5A. Claim 18 is certainly generic with respect to this embodiment.

The remaining added dependent claims parallel those of pending dependent claims 19-24.

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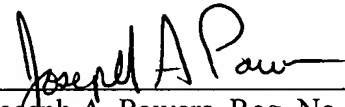
V. Conclusion

In view of the foregoing remarks and amendments, the Applicant submits that this application is in condition for allowance at an early date, which action is earnestly solicited.

The Commissioner for Patents is hereby authorized to charge any additional fees or credit any excess payment that may be associated with this communication to deposit account **04-1679**.

Respectfully submitted,

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